ASSIGNMENT 2

Textbook Assignment: Unit 1, Lesson 2, "The Ocean Body." Pages 1-2-7 through 1-2-12.
Unit 1, lesson 3, "The Ocean Floor." Pages 1-3-1 through 1-3-5.
Unit 1, Lesson 4, "Oceanographic Analysis." Pages 1-4-1 through 1-4-10.

Learning Objective: Identify the layers of the 3-layer ocean model, and differentiate between mechanical and convective mixing (continued).

2-1. At some latitudes and during some seasons of the year there are two thermoclines; the Main Thermocline and the Seasonal Thermocline. During which season and at which latitude should you normally expect to observe both thermoclines?

1. Summer, middle latitudes
2. Winter, middle latitudes
3. Summer, high latitudes
4. Winter, high latitudes

2-2. What is the basic characteristic of the Deep Water Layer?

1. Generally isothermal water at temperatures less than 4°C below the Main Thermocline
2. Generally isothermal water at temperatures below 4°C at depths greater than 1,200 meters (3,940 feet)
3. Generally isothermal or slowly decreasing water at temperatures below 4°C below 2,100 feet (650 meters)
4. Generally isothermal water at temperatures less than 4°C below 300 feet (91 meters)

2-3. The top of the Deep Water Layer can be found as shallow as which of the following values?

1. Surface
2. 300 ft
3. l,200 ft
4. 2,100 ft

2-4. On the average, the top of the Deep Water Layer can be found as deep as which of the following values?

1. 1,200 ft
2. 1,500 ft
3. 2,100 ft
4. 3,000 ft

Learning Objective: Define water mass and water type and identify the properties used in their classification; recognize the oceans' basic vertical structure with regard to their latitudinal distribution; and recognize their source regions and how they are formed.

2-5. What values define water <u>type?</u>

1. The salinity and temperature values
2. The range of temperature values
3. The range of salinity values
4. The range of salinity and temperature values

2-6. What values define water <u>mass?</u>

1. The salinity and temperature values
2. The range of temperature values
3. The range of salinity values
4. The range of salinity and temperature values

2-7. How many layers of ocean water may be identified in the high latitudes?

1. One
2. Five
3. Three
4. Four

2-8. What feature separates surface waters from water that is classified by type and mass?

1. Mixed layer
2. Seasonal thermocline
3. Main thermocline
4. Inversion

2-9. Which of the following is a source region for central water?

1. The area where the Labrador Current meets the Gulf Stream System
2. The area where the Kuroshio Current meets the Oyashio Current
3. The areas where the Agulhas Current meets the West Wind Drift Current
4. Each of the above

2-10. Which, if any, of the following characteristics identifies a central water mass?

1. Surface salinity
2. Surface temperature
3. Surface water color
4. None of the above

2-11. Where is Equatorial Water located?

1. Near the equator in the Pacific and the Indian Oceans
2. Near the equator in the Pacific and Atlantic
3. Near the equator only in the Pacific Ocean
4. Only in the northern portion of the Indian Ocean (the Arabian Sea)

2-12. Where is Intermediate Water located?

1. Between Central Water masses
2. Below Central Water masses in the North Atlantic and South Atlantic
3. Below Central Water in all oceans
4. Below Central Water in the poleward portions of the oceans only

2-13. How far north does Antarctic Intermediate Water extend?

1. 35°N
2. Equator
3. 10°S
4. 35°S

2-14. In the Atlantic, where does the Arctic Intermediate Water form?

1. Where the Gulf Stream converges with the Labrador Current
2. In a small area east of the Grand Banks
3. In the Davis Straits
4. In the Labrador Sea

2-15. Which of the following is a characteristic common to all Bottom and Deep Water masses?

1. They form at the surface
2. They have very high density
3. They exist in both hemispheres
4. Each of the above

2-16. Which, if any, of the following three water masses mix to form Subantarctic Water?

1. Antarctic Intermediate, Antarctic Bottom, and North Atlantic Deep
2. Antarctic Intermediate, Antarctic Bottom, and Central
3. Antarctic Intermediate, Antarctic Bottom, and Equatorial
4. None of the above

2-17. At which depth does the dense (warm, high salinity) water from the Mediterranean mix with Central Water to form Mediterranean Water?

1. 1,000 meters
2. 1,500 meters
3. 2,500 meters
4. 3,500 meters

2-18. What indication could you see on an AN/SSQ-61 bathythermograph trace to indicate a layer of Mediterranean Water west of the Straits of Gibraltar?

1. A layer of high salinity water at depths near 1,000 meters
2. A layer of warm water at depths near 1,000 meters
3. A layer of low salinity water at depths near 1,000 meters
4. A layer of cold water at depths near 1,000 meters

Learning Objective: Recognize how deep-ocean circulation differs from surface circulation and how the circulation pattern is maintained.

2-19. Which of the following correctly states the difference between surface currents?

1. Deep-ocean currents are faster than surface currents
2. Deep-ocean currents flow predominately in a north-to-south direction
3. Deep-ocean currents do not cross the equator
4. Deep-ocean currents are wind driven

2-20. The term *thermohaline circulation* means a circulation caused by differences in

1. temperature only
2. salinity only
3. temperature and salinity
4. pressure only

2-21. Which of the following water masses is the most dense?

1. Red Sea Water
2. Arctic Intermediate
3. North Atlantic Bottom
4. Antarctic Bottom

2-22. In a vertical cross-section of the tropical region of the South Atlantic we may find: (1) Antarctic Bottom Water, (2) Central Water, (3) North Atlantic Deep/Bottom Water, (4) Antarctic Intermediate Water, and (5) Surface water (the mixed layer). What is the correct order of these water masses, from top to bottom?

1. 5, 4, 2, 3, 1
2. 5, 2, 4, 3, 1
3. 5, 2, 4, 1, 3
4. 5, 4, 2, 1, 3

2-23. In what direction does Central Water of the South Atlantic flow?

1. Northward
2. Southward
3. Eastward
4. Westward

2-24. In what direction does Intermediate Water flow?

1. Poleward
2. Equatorward
3. Eastward
4. Westward

Learning Objective: Name and describe the five major ocean provinces and the relief features associated with the ocean bottom.

2-25. What percent of the ocean bottom is covered by the continental shelf?

1. 2.5
2. 5.5
3. 7.5
4. 10.5

2-26. What is the average slope of the continental shelf?

1. 12 feet per mile
2. 6 feet per mile
3. 60 fathoms per mile
4. 1 foot per 100 feet

2-27. In which direction do currents set (flow) over the continental shelf?

1. Directly toward shore
2. Directly away from shore
3. Parallel to shore
4. At a 45° angle away from shore

2-28. On the outer edge of the continental shelf, the slope suddenly becomes as much as 20 times as steep as the continental shelf. What is this area called?

1. Continental rise
2. Continental slope
3. Terrace
4. Ridge

2-29. Which of the following features is NOT found on the continental shelf?

1. Canyon
2. Depression
3. Terrace
4. Valley

2-30. The fan-like sediment feature at the base of canyons in the continental slope form what feature?

1. Continental rise
2. Alluvial deposit
3. Debris pile
4. Ridges

2-31. What is the term for the deep ocean feature that accounts for 76% of the ocean's floor?

1. Continental rise
2. Continental slope
3. Continental shelf
4. Ocean basin

2-32. What is the depth range of the ocean basins?

1. 500 to 3,000 ft
2. 1,500 to 3,000 ft
3. 1,500 to 3,000 fathoms
4. 1,500 to 3,000 meters

A. GUYOT
B. SEAMOUNT
C. ATOLL
D. VOLCANIC ISLAND

FIGURE 2A

IN ANSWERING QUESTIONS 2-33 THROUGH 2-36, CHOOSE THE TERM FROM FIGURE 2A THAT BEST FITS THE FEATURE DESCRIBED IN EACH QUESTION. TERMS ARE USED ONLY ONCE.

2-33. An island formed by volcanic activity, usually having steep mountains in the central area.

1. A
2. B
3. C
4. D

2-34. A seamount that has, through coral deposits, raised above the ocean surface.

1. A
2. B
3. C
4. D

2-35. A submerged, isolated, pinnacled mountain rising 3,000 feet or more above the sea floor.

1. A
2. B
3. C
4. D

2-36. A submerged, isolated, flat-topped mountain rising 3,000 feet or more above the sea floor.

1. A
2. B
3. C
4. D

A. MID-OCEAN RIDGE B. SILL C. CANYON D. TRENCH

FIGURE 2B

IN ANSWERING QUESTIONS 2-37 THROUGH 2-40, CHOOSE THE TERM FROM FIGURE 2B THAT BEST FITS THE FEATURE DESCRIBED IN THE QUESTION. TERMS ARE USED ONLY ONCE.

2-37. Elevated portion of the sea floor that separates ocean basins and results in the restriction of bottom water movement.

1. A
2. B
3. C
4. D

2-38. Deep, steep-sided depression in the ocean basins, usually found on the seaward side of island arcs.

1. A
2. B
3. C
4. D

2-39. An extensive raised portion of the sea floor in the central portion of the ocean.

1. A
2. B
3. C
4. D

2-40. A deep crevasse or cut in the continental slope formed by turbidity currents.

1. A
2. B
3. C
4. D

Learning Objective: Name and describe the various types of bottom sediments.

A. PELAGIC B. TERRIGENOUS C. VOLCANIC D. GLACIAL MARINE

FIGURE 2C

IN ANSWERING QUESTIONS 2-41 THROUGH 2-44. CHOOSE THE TERM FROM FIGURE 2C THAT BEST FITS THE TYPE OF SEDIMENT DESCRIBED IN THE QUESTION. TERMS ARE USED ONLY ONCE.

2-41. Sediment of land origin (silt, clay, dust, sand).

1. A
2. B
3. C
4. D

2-42. Deep water sediments formed by shell and skeletal remains of marine plant and animal life.

1. A
2. B
3. C
4. D

2-43. Deposits from former glaciers and debris from melting icebergs.

1. A
2. B
3. C
4. D

2-44. Pumice and ash sediments.

1. A
2. B
3. C
4. D

Learning Objective: Evaluate wave height data and recognize its uses and analysis procedures.

2-45. In a wave height analysis, contour lines are drawn based on which of the following plotted information?

1. Wave period
2. Wave height
3. Wave direction
4. Wind speed and direction

2-46. What is the first step you should do when analyzing a wave height chart?

1. Review the most recent wave height analysis chart and transfer history to the new chart
2. Draw contour lines at 3 foot intervals
3. Visually review wave height plots
4. Mentally draw wave height contours to find a continuous closed contour

2-47. When constructing a wind-wave height (sea height) analysis, you must surround appropriate wave height reports with contours. Additionally, you must draw your contours to agree with and follow the pattern of which of the following features?

1. Wind fetch areas able to produce equal or greater wave heights
2. Areas of equal or greater swell wave heights
3. Areas of different wave direction
4. Areas containing no reports

2-48. You may begin and end wave height contours along a coastline.

1. True
2. False

2-49. An area of water is affected by a brisk offshore wind. Where will the highest height contour associated with that fetch area be located?

1. Along the coastline
2. Off shore 1-2 mi
3. Off shore 3-4 mi
4. Off shore 5-7 mi

2-50. With an on-shore wind, coastal sea heights are limited by the fetch area and duration.

1. True
2. False

2-51. Which of the following conditions affects coastal sea wave heights?

1. Sea breezes
2. Gravity winds
3. Funneling
4. Each of the above

2-52. In the open ocean, sea heights may be higher than the fetch and duration normally support when winds oppose a strong current.

1. True
2. False

2-53. A wave height analysis that includes <u>only</u> contours drawn for swell wave heights is called a

1. sea height analysis
2. contour analysis
3. combined wave analysis
4. swell wave analysis

2-54. What is the term used to describe the wave height analysis based on the highest 1/10th of wave heights that can be produced by the various fetch and duration areas?

1. Sea height analysis
2. Significant (or Sig) wave height analysis
3. Combined wave height (or C-height) analysis
4. Swell height analysis

Learning Objective: Evaluate sea-surface temperature data and recognize its uses and analysis procedures.

NOTE : ALTHOUGH NOT DISCUSSED IN THE TRAMAN, MOST SEA-SURFACE TEMPERATURE ANALYSES ARE CURRENTLY DONE ON COMPUTER DISPLAYS USING THE CURRENT AND PREVIOUS DAY'S CALIBRATED SATELLITE IMAGERY SUPPLEMENTED BY SHIP REPORTED SEAWATER TEMPERATURES. MOST SHIPS ACTUALLY REPORT SEAWATER INJECTION TEMPERATURES AS THE SEA-SURFACE TEMPERATURE. IN MANY CASES, THIS RESULTS IN LARGE ERRORS. INJECTION WATER IS TAKEN AT THE 30 TO 40 FOOT LEVEL ON AIRCRAFT CARRIERS AND AS DEEP AS 80 FEET ON SOME SUPERTANKERS.

2-55. Which of the following activities use sea-surface temperatures on a routine basis?

1. Coast Guard, Navy, and Air Force search and rescue (SAR)
2. Civil, NOAA, Navy, and Air Force weather forecasters
3. Navy antisubmarine warfare platforms
4. All of the above

2-56. When you are constructing a sea-surface temperature analysis, what data is acceptable for use?

1. Only data from the previous synoptic hour
2. Only data from the previous synoptic hour plus the last intermediate synoptic hour
3. Only data less than 24 hours old
4. Any data less than 5 days old

2-57. Sea-surface temperature is conservative; the temperature changes slowly.

1. True
2. False

2-58. The first step in analyzing ship-reported sea-surface temperatures is to

1. draw a closed contour
2. sketch a closed contour in pencil
3. transfer history onto the current chart in yellow pencil or marker
4. mentally sketch several contours

2-59. What is the normal isotherm interval used on sea-surface temperature analysis charts?

1. 1°C
2. 2°C
3. 3°C
4. 4°C

2-60. Isotherms tend to follow isobaths, particularly over the continental slope.

1. True
2. False

A. EDDY
B. ECKMAN SPIRAL
C. UPWELLING
D. FRESHWATER RUNOFF

FIGURE 2D

IN ANSWERING QUESTIONS 2-61 THROUGH 2-64, CHOOSE THE TERM FROM FIGURE 2D THAT BEST FITS THE FEATURE DESCRIBED IN THE QUESTION. TERMS MAY BE USED MORE THAN ONCE, OR MAY NOT BE USED AT ALL.

2-61. Produces cold pockets of water, usually elongated along a coastline, which may or may not coincide with river mouths.

1. A
2. B
3. C
4. D

2-62. Produces circular patches of warm water on the pole side of warm currents and circular patches of cold water on the equator side of warm currents.

1. A
2. B
3. C
4. D

2-63. Produces tongues of colder or warmer water near the mouths of rivers.

1. A
2. B
3. C
4. D

2-64. A feature that, when classified cold will exhibit a counterclockwise rotation, and when classified warm will exhibit a clockwise rotation.

1. A
2. B
3. C
4. D

Learning Objective:
Evaluate layer depth data. Recognize it's uses and the analysis procedures.

2-65. On a plotted layer depth report, what does a "+" next to the depth mean?

1. The reported temperature at that depth is unreliable
2. The MLD and SLD are at the same level
3. The water temperature increases from the surface to the plotted level
4. The MLD may be deeper than the reported depth

2-66. What process is/are indicated by a decrease in SST from one chart to the next?

1. Cold surface water advection
2. Mixing of the near surface water with a cooler subsurface layer
3. Either 1 or 2, or both 1 and 2 may be occurring
4. Heavy rainfall has occurred

2-67. What, if anything, happens to the MLD when either cold water advection with continued mixing or no thermal advection occurs but mixing increases to a greater depth?

1. It separates from the SLD
2. Increases
3. Decreases
4. Nothing

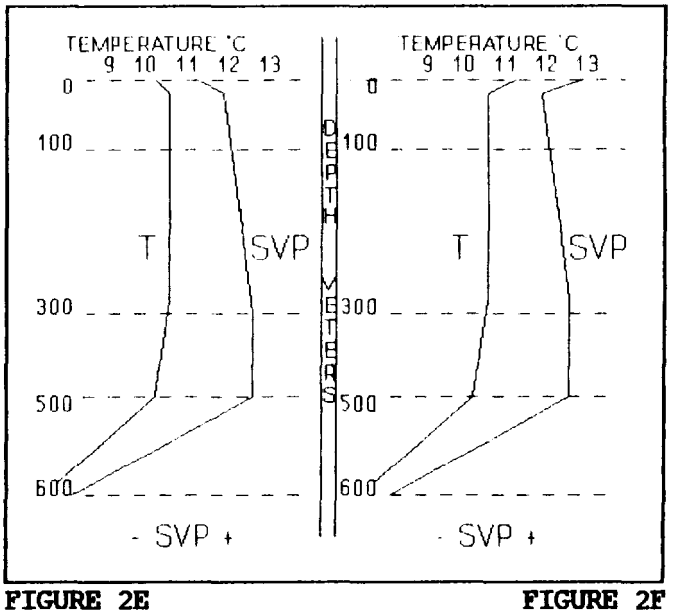

FIGURE 2E **FIGURE 2F**

USE FIGURES 2E AND 2F TO ANSWER QUESTIONS 2-68 THROUGH 2-71. IN FIGURE 2E, THE MID IS FIRMLY ESTABLISHED AT 500 METERS AT THE TOP OF THE MAIN THERMOCLINE. FIGURE 2E REPRESENTS A NIGHT BT TEMPERATURE TRACE WITH A COMPUTED SOUND VELOCITY PROFILE, WHILE FIGURE 2F REPRESENTS A LATE AFTERNOON BT TEMPERATURE TRACE WITH A COMPUTED SOUND VELOCITY PROFILE.

2-68. What process is represented by the change between figure 2E and 2F?

1. Diurnal heating or the "afternoon effect"
2. Cold water advection
3. Increased mixing
4. Salinity increase

2-69. How, if at all, does the development of a conditional thermocline, as shown in figure 2F, affect the Mixed Layer Depth?

1. The MLD rises to the top of the conditional thermocline (surface)
2. The MLD rises to the base of the conditional thermocline (about 30 meters)
3. The MLD rises to 300 meters
4. There is no change in the MLD

2-70. Where is the SLD located in figure 2E?

1. At the surface
2. Near 300 meters
3. Near 500 meters
4. Deeper than 600 meters

2-71. Where is the SLD located in figure 2F?

1. Deeper than 600 meters
2. At 500 meters
3. Near 300 meters
4. At the surface

Learning Objective: Recognize how bathythermograph data is used and how vertical temperature gradients are computed.

2-72. What is the temperature gradient for a layer between 55 meters (20.0°C) and 125 meters (16.0°C)?

1. 4.0°C per 70 meters
2. 1.8°C per 31 meters
3. -4.0°C per 70 meters
4. -1.8°C per 31 meters

2-73. A temperature gradient of about -0.2°C per 31 feet equates to the speed of sound remaining constant with depth. If a bathythermograph report shows an isothermal layer (gradient 0.0°C per 31 feet), would the speed of sound change with increasing depth through this layer? If so, how?

1. Yes; first increase, then decrease
2. Yes; increase
3. Yes; decrease
4. No

2-74. In a layer where a bathythermograph report shows a strong negative temperature gradient, are sound waves refracted? If so, how?

1. Yes; bent downward
2. Yes; bent upward
3. Yes; bent downward near the source and upward further away from the source
4. No